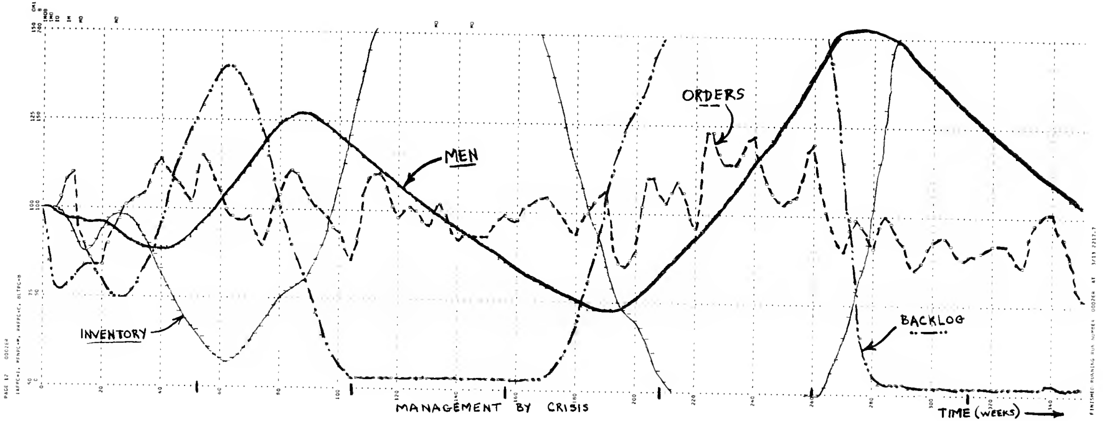
②

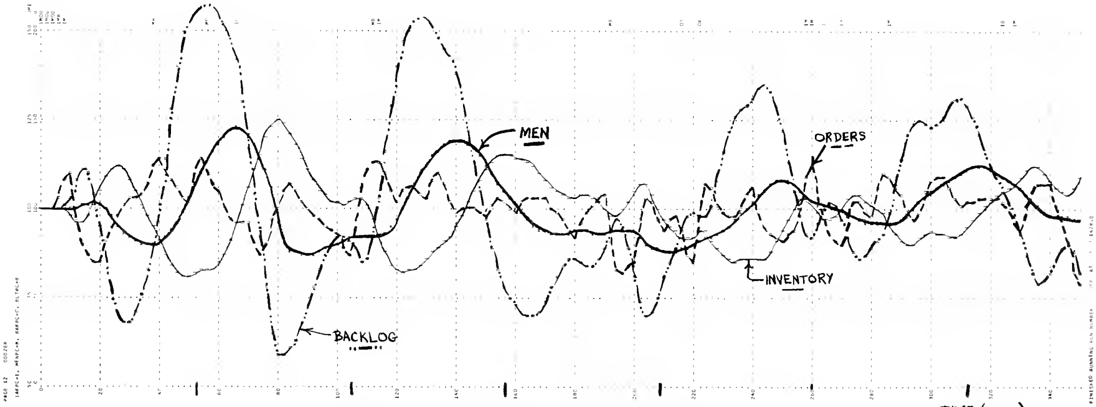
[illegible] to increase [illegible]

Similarly, when a period [illegible] difficulties, shows a great excess [illegible] will be taken to reduce the inventory position [illegible] of our manufacturing firms have [illegible] The dynamic [illegible] such a firm, as here illustrated by simulation [illegible] Dynamics model, has the appearance of [illegible] swings in sales, inventories, employment, order backlog, [illegible] bility. The potential for a well-designed management control system in such a firm is enormous.

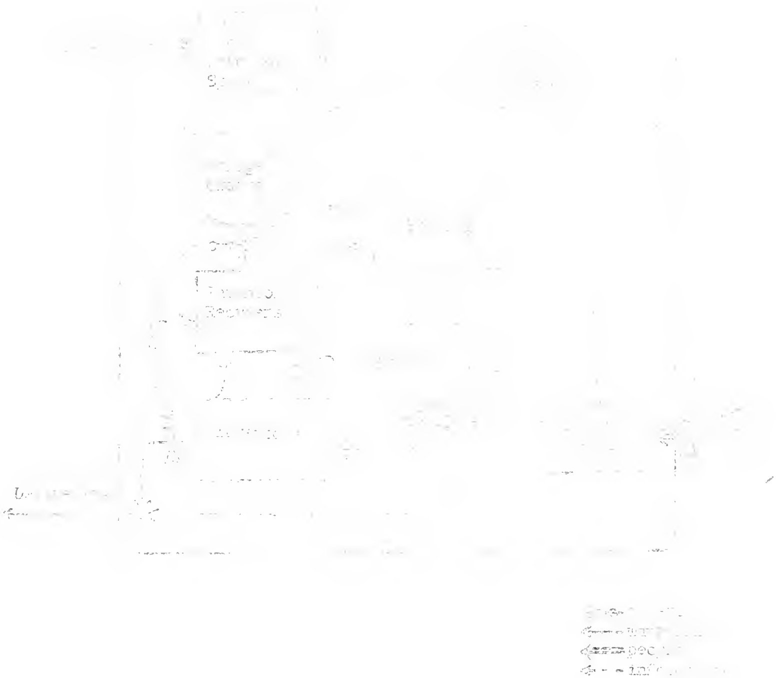
The traditional approach [illegible] in the [illegible] approach") to the design of a control system for such an organization will recognize that: (1) better information on sales is necessary, (2) such information should [illegible] to eliminate possibilities of factory response to chance [illegible]; (3) inventories should be periodically (perhaps even continuously) checked, and reorders generated when needed to bring stocks [illegible] target inventories; (4) order backlogs should not be allowed to [illegible] from the normal levels; and (5) work force should be [illegible] the desired production rate that stems from consideration of current [illegible] volume and the manufacturing backlog situation. Using our [illegible] model, we can readily build into the model a management control system that incorporates all these features. The modeled company would then be a leader in the use of management control techniques. And, as Figure 4 illustrates, the company would have benefited by this approach. With the new control



MANAGEMENT BY CRISIS



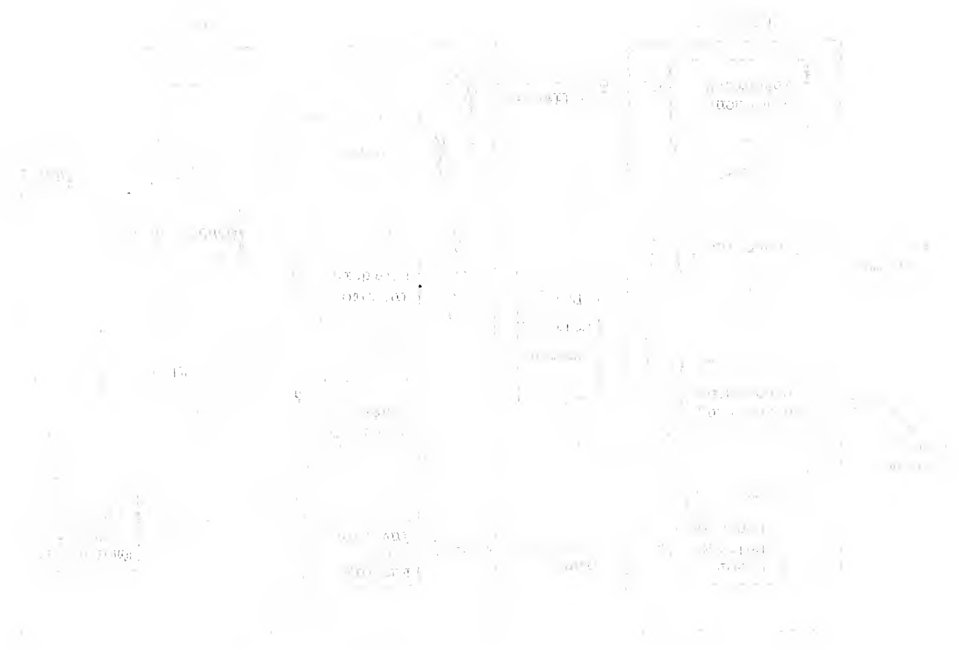
EFFECTS OF MANAGEMENT CONTROL SYSTEMS



[illegible]

[illegible]

[illegible]

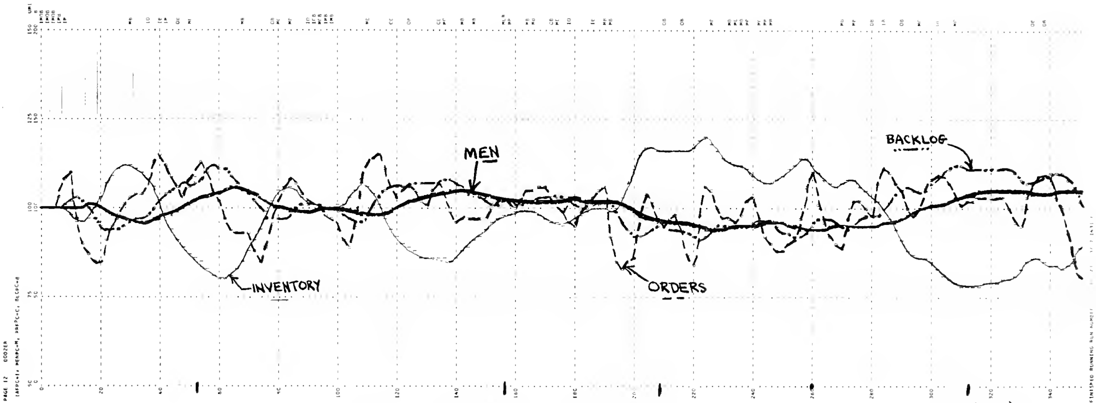


[illegible]

[illegible] spheres II and III of [illegible] posed to show the [illegible] a higher degree of [illegible] which has not been [illegible]

[illegible]

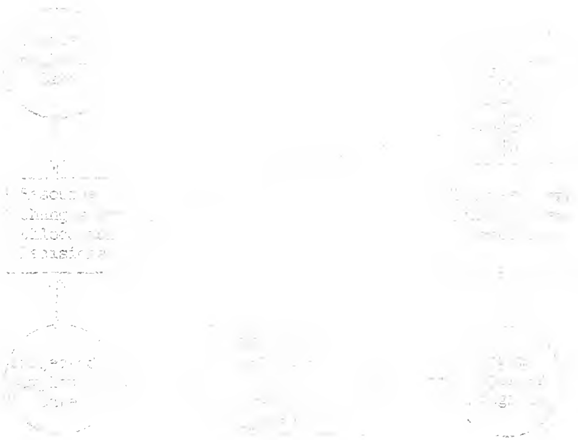
[illegible]



EFFECTS OF INDUSTRIAL DYNAMICS POLICIES

[illegible]

[illegible]



[illegible]

[illegible]

[illegible] (a [illegible] example, for [illegible] employ[illegible] [illegible] the project [illegible] and forecasting [illegible]

But the design of [illegible] or [illegible] of assumptions [illegible] of the real system [illegible] example, the lack [illegible] ignored. [illegible] between the real situation in the project [illegible] to date) and that which is *apparent* [illegible].

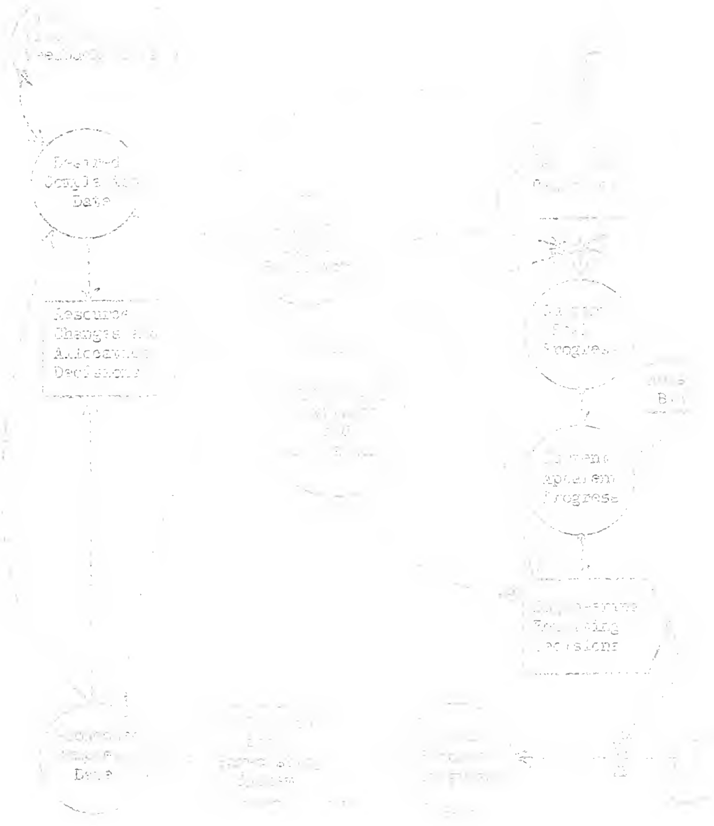
Another part of the real [illegible] to be ignored [illegible] R and D control system [illegible] in the project [illegible] and decisions. The [illegible] engineers and manag[illegible] their knowledge of the schedules [illegible] project, [illegible] believed penalty-reward structure [illegible] affect the progress and products that are [illegible]. Furthermore, these [illegible] progress [illegible] project objectives. [illegible] systems [illegible] (in R and D, manufacturing, government [illegible] attitudes and pressures [illegible] and character of [illegible] and their results. [illegible] which compares "actual [illegible]

[illegible]

[illegible] special project [illegible] management [illegible] required to be [illegible] useful [illegible] to [illegible] integrated [illegible]

Among these [illegible] design process [illegible] opment system that the [illegible] representation of the [illegible] of the product [illegible] characteristics [illegible] tours the [illegible] project life cycles. Such [illegible] combined effort [illegible] the full range of [illegible] a [illegible] opment project from [illegible] idea for the product to final completion [illegible] development program [illegible] project system [illegible] Industrial Dynamics [illegible] development project dynamics.

Some of the [illegible] of par-ticular interest to designers of [illegible] They demon-strate the importance of taking [illegible] problem solution in attempting to [illegible] For example, one [illegible] was con-ducted in which [illegible] project [illegible]


Desired
Completion
Date
Resource
Changes and
Allocation
Decisions
Progress
Current
System
Progress
Decisions
Date

[illegible]

Figure 1[illegible]. [illegible] for [illegible] Projects

[illegible] [illegible] [illegible] [illegible] schedule [illegible] complete the project during the [illegible] [illegible] however, the actual completion dates of the projects [illegible] [illegible] insensitive to the changes in desired completion date.

Figure [illegible] demonstrates [illegible] [illegible] using the data of four recent simulations. The [illegible] [illegible] of the scheduled project [illegible] [illegible] [illegible] [illegible] the vertical axis [illegible] [illegible] [illegible] [illegible] the range. If changes in schedule produced corresponding changes in actual completion dates, the curve of results would [illegible] the [illegible] "perfect response" line; that is, a 50 percent reduction in scheduled duration should produce a 50 percent reduction in actual duration, if control is

Figure 11. [illegible]

[illegible] the change effort, only 25 percent [illegible] changes [illegible] the model change is [illegible] in the [illegible] organization [illegible] inefficiencies [illegible] hours [illegible] does [illegible] customer dissatisfaction [illegible] shift [illegible] the [illegible] schedule.

[illegible] the [illegible] the slippage in [illegible] function of [illegible] points in [illegible] the project [illegible] slippage of 242 [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]


Region

[illegible]

[illegible]

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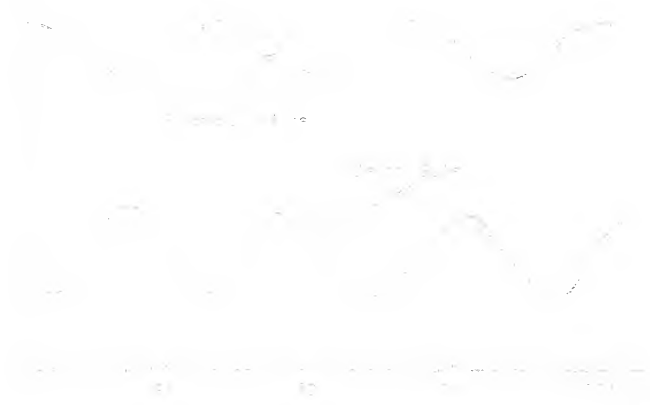
[illegible]

[illegible]



[illegible]

[illegible] hundred timing plants. The manager has almost no way of checking th[illegible]

[illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] the [illegible] of [illegible] in Figure [illegible] [illegible] [illegible] behavioral system.

[illegible] as shown in the [illegible] rejects being [illegible]

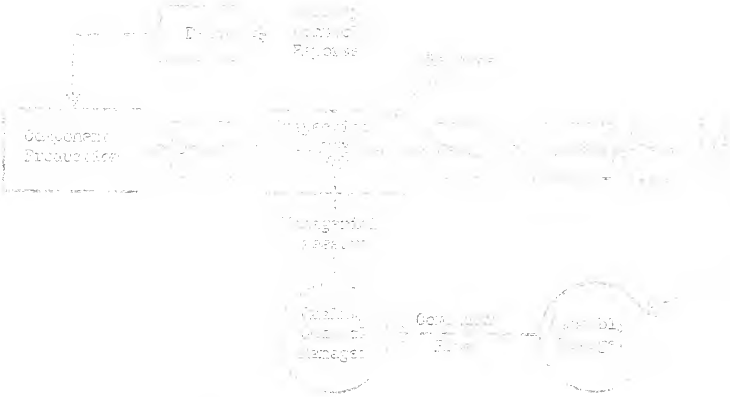


Figure 15. [illegible] Graphical Representation of Quality Control [illegible]

[illegible]

[illegible]

and [illegible] which [illegible] the [illegible] the assembly operation [illegible] the tube is [illegible] are far more [illegible] inspection [illegible] eventually [illegible] failure [illegible] manager to the [illegible] build, the quality control manager [illegible] more careful [illegible] of [illegible] pressure, the inspectors [illegible] measure of good quality, the [illegible] jective standards and inspection [illegible] pressure from the manager, the inspectors [illegible] including many which are actually of acceptable [illegible] rejects rise, fewer poor grids enter the assembly process, [illegible] fewer tube failures in test. The assembly manager's [illegible] and in fact soon switch to a concern for getting more [illegible] assembly operation without pressure from the quality control manager, [illegible] counterpressure to get more grids to the assembly operation, the grid inspectors tend to slacken gradually their care and their reject [illegible]. Eventually, the number of rejectable grids getting into the tube assembly creates the problem of tube failures again, and the cycle [illegible]. Given normal delays in such a process, the entire cycle takes on a seasonal appearance. Thus, a system intended to assure control of product quality actually

[illegible]

[illegible]

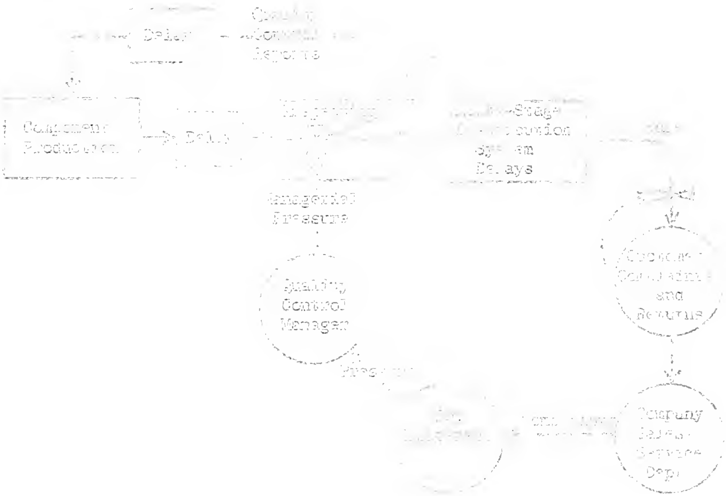


Figure 16. Total Quality Control System

[illegible] manager [illegible] changed [illegible] both Figures 15 and 16 the quality control manager's [illegible] key to system [illegible] the manager of the formal quality control

[illegible]

the product [illegible]

IV. [illegible] System Design

The examples discussed [illegible] suggest [illegible] control systems. Studying [illegible] management control system design.

A. The key to effective control [illegible] of considerations [illegible] the formal boundaries of the company organization.

Too many organizations give up altogether too soon the search for mastering a management problem caused by factors apparently outside of our control. The cyclic swings in customer orders in the production-inventory case, government changes in project funding in research and development, and variations of product reject rate in the quality control problem are all examples of such factors. Yet in each case successful control system management rests within the access of company policy.

In the Sprague case the system requiring control included the ordering decisions of the customer, certainly not part of Sprague's formal organization. But the basis for system control exists in the stabilization of the input to the customer decision, the component delivery delay. Again, project success in R and D is strongly influenced by company integrity and [illegible]. Yet customer, not company, policy can be redesigned to achieve desirable company behavior. And the key to quality control involves recognition of the total

[illegible]

The [illegible] be [illegible]

B. [illegible]

[illegible] have [illegible] ing for [illegible] model a decision [illegible] their [illegible] control [illegible] ing of aggregate [illegible] system. Our [illegible] R and D control [illegible] decision-making [illegible] tions. Finally, we [illegible] making the [illegible] of both managers and [illegible] quality control case.

These illus[illegible] recognize and cope with the [illegible] response in organizations. The decision-makers, single or aggregated--[illegible]

[illegible]

[illegible] which [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
within a [illegible].

[illegible] together.

In the Sp[illegible] [illegible] [illegible] [illegible] [illegible] [illegible] recommendations [illegible] [illegible] [illegible] [illegible] marketing [illegible] only [illegible] [illegible] [illegible] [illegible] [illegible] (finance, personnel). [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] problem [illegible] [illegible] [illegible] [illegible] [illegible] policy-making level of the firm. The type [illegible] [illegible] [illegible] development tend not to be [illegible] management [illegible] [illegible] [illegible] but rather top management policy [illegible] [illegible] [illegible] customer relations [illegible] [illegible] [illegible] [illegible] [illegible] systems can therefore [illegible] [illegible] [illegible] [illegible] [illegible] as a whole, and not just [illegible] [illegible] [illegible] [illegible] [illegible] a great [illegible] [illegible] [illegible] [illegible] [illegible] programming of control systems on [illegible] level of the company by people who [illegible] [illegible] system [illegible] [illegible] [illegible] [illegible] [illegible] achieve broad system integration.

The Industrial Dynamics program has demonstrated the possibilities of examining and treating system problems of great variety and scope

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